REGION II RST
DELIVERABLE SIGN-OFF SHEET

TDD#: TO-0006-0061
TASK#: 2061
TASK/SITE: Final Site-Specific UFP QAPP – Niagara Falls Boulevard Site
DC#: RST3-02-F-0153

Principal Author(s)

Joel Petty	Date

Technical Editor

Smita Sumbaly	Date

Group Leader / Peer Review

Smita Sumbaly	Date

Approval (Program Manager / Operations Manager)

Timothy Benton	Date

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REMOVAL SUPPORT TEAM 3
EPA CONTRACT EP-S2-14-01

August 6, 2015

Eric Daly, On-Scene Coordinator
U.S. Environmental Protection Agency
Response & Prevention Branch
2890 Woodbridge Avenue
Edison, NJ 08837

EPA CONTRACT NO: EP-S2-14-01
TDD NO: TO-0006-0061
DOCUMENT CONTROL NO: RST3-02-F-0153
SUBJECT: FINAL SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN
NIAGARA FALLS BOULEVARD SITE

Dear Mr. Daly,

Enclosed please find the Final Site-Specific UFP Quality Assurance Project Plan (QAPP) for the radiological survey, air sampling, and soil sampling event to be conducted at the Niagara Falls Boulevard Site located in Niagara Falls, Niagara County, New York, from August 10 through 14, 2015.

If you have any questions or comments, please do not hesitate to contact me at (732) 585-4413

Sincerely,
Weston Solutions, Inc.

Bernard Nwosu
RST 3 Site Project Manager

Enclosure
cc: TDD File No.: TO-0006-0061

FINAL SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN
NIAGARA FALLS BOULEVARD SITE
NIAGARA FALLS, NIAGARA COUNTY, NEW YORK

Prepared By:

Removal Support Team 3
Weston Solutions, Inc.
Engineering, Science, and Technology Division
Edison, New Jersey 08837

DC No.: **RST3-02-F-0153**
TDD No.: TO-0006-0061
EPA Contract No.: EP-S2-14-01

August 2015

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LIST OF ACRONYMS

ADR	Automated Data Review
ANSETS	Analytical Services Tracking System
AOC	Acknowledgment of Completion
ASTM	American Society for Testing and Materials
CEO	Chief Executive Officer
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
CFM	Contract Financial Manager
CO	Contract Officer
COI	Conflict of Interest
COO	Chief Operations Officer
CRDL	Contract Required Detection Limit
CRTL	Core Response Team Leader
CRQL	Contract Required Quantitation Limit
CQLOSS	Corporate Quality Leadership and Operations Support Services
CWA	Clean Water Act
DCN	Document Control Number
DESA	Division of Environmental Science and Assessment
DI	Deionized Water
DPO	Deputy Project Officer
DQI	Data Quality Indicator
DQO	Data Quality Objective
EM	Equipment Manager
EDD	Electronic Data deliverable
ENVL	Environmental Unit Leader
EPA	Environmental Protection Agency
ERT	Environmental Response Team
FASTAC	Field and Analytical Services Teaming Advisory Committee
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HRS	Hazard Ranking System
HSO	Health and Safety Officer
ITM	Information Technology Manager
LEL	Lower Explosive Limit
MSA	Mine Safety Appliances
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration

LIST OF ACRONYMS (Concluded)

OSWER	Office of Solid Waste and Emergency Response
PARCCS Comparability,	Precision, Accuracy, Representativeness, Completeness, Sensitivity
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PIO	Public Information Officer
PM	Program Manager
PO	Project Officer
PRP	Potentially Responsible Party
PT	Proficiency Testing
QA	Quality Assurance
QAL	Quality Assurance Leader
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RC	Readiness Coordinator
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RSCC	Regional Sample Control Coordinator
RST	Removal Support Team
SARA	Superfund Amendments and Reauthorization Act
SEDD	Staged Electronic Data Deliverable
SOP	Standard Operating Practice
SOW	Statement of Work
SPM	Site Project Manager
START	Superfund Technical Assessment and Response Team
STR	Sampling Trip Report
TAL	Target Analyte List
TCL	Total Compound List
TDD	Technical Direction Document
TDL	Technical Direction Letter
TO	Task Order
TQM	Total Quality Management
TSCA	Toxic Substances Control Act
UFP	Uniform Federal Policy
VOA	Volatile Organic Analysis

CROSSWALK

The following table provides a "cross-walk" between the QAPP elements outlined in the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP Manual), the necessary information, and the location of the information within the text document and corresponding QAPP Worksheet. Any QAPP elements and required information that are not applicable to the project are circled.

QAPP Element(s) and Corresponding Section(s) of UFP-QAPP Manual		Required Information	Crosswalk to QAPP Section	Crosswalk to QAPP Worksheet No.
Project Management and Objectives				
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2.2	Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	TOC Approval Page	2
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2.4	Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications - Special Personnel Training Requirements	2	5 6 7 8
2.5	Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	1	9 10
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2.8	Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- - -	Summary of Project Tasks Reference Limits and Evaluation Project Schedule/Timeline	4	14 15 16
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QAPP Worksheet #1: Title and Approval Page

Title: Site-Specific UFP Quality Assurance Project Plan
Site Name/Project Name: Niagara Falls Boulevard Site
Site Location: Niagara Falls, Niagara County, New York
Revision Number: 00
Revision Date: Not Applicable

Weston Solutions, Inc.
Lead Organization

Joel Petty
Weston Solutions, Inc.
1090 King Georges Post Road, Suite 201
Edison, NJ 08837
Email: joel.petty@westonsolutions.com

Preparer's Name and Organizational Affiliation

6 August 2015
Preparation Date (Day/Month/Year)

Site Project Manager: _____
Signature

Bernard Nwosu/Weston Solutions, Inc.
Printed Name/Organization/Date

QA Officer/Technical Reviewer: _____
Signature

Smita Sumbaly/Weston Solution, Inc.
Printed Name/Organization/Date

EPA, Region II On-Scene Coordinator (OSC): _____
Signature

Eric Daly/EPA, Region II
Printed Name/Organization/Date

EPA, Region II Quality Assurance Officer (QAO): _____
Signature

Printed Name/Organization/Date

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Niagara Falls Boulevard Site
Site Location: Niagara Falls, Niagara County, New York
Operable Unit: 00
Title: Site-Specific UFP Quality Assurance Project Plan
Revision Number: 00
Revision Date: Not Applicable

1. **Identify guidance used to prepare QAPP:**
   Uniform Federal Policy for Quality Assurance Project Plans. Refer to Laboratory Methods.
2. **Identify regulatory program:** EPA, Region II
3. **Identify approval entity:** EPA, Region II
4. **Indicate whether the QAPP is a generic or a site-specific QAPP.**
5. **List dates of scoping sessions that were held:** 7/13/2015, 7/27/2015
6. **List dates and titles of QAPP documents written for previous site work, if applicable:**

   Not applicable
7. **List organizational partners (stakeholders) and connection with lead organization:**

   None
8. **List data users:** EPA, Region II (see Worksheet #4 for individuals)
9. **If any required QAPP elements and required information are not applicable to the project, then provide an explanation for their exclusion below:** None
10. **Document Control Number:** RST3-02-F-0153

QAPP Worksheet #3: Distribution List

[List those entities to which copies of the approved site-specific QAPP, subsequent QAPP revisions, addenda, and amendments are sent]

QAPP Recipient	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Eric Daly	On-Scene Coordinator	EPA, Region II	(732) 321-4350	(732) 321-4350	Daly.Eric@epa.epamail.gov	RST 3-02-F-0153
Bernard Nwosu	Site Project Manager	Weston Solutions, Inc., RST 3	(908) 565-2980	(732) 225-7037	Ben.Nwosu@westonsolutions.com	RST 3-02-F-0153
Smita Sumbaly	QA Officer	Weston Solutions, Inc., RST 3	(732) 585-4410	(732) 225-7037	S.Sumbaly@westonsolutions.com	RST 3-02-F-0153
Site TDD File	RST 3 Site TDD File	Weston Solutions, Inc., RST 3	Not Applicable	Not Applicable	Not Applicable	-

QAPP Worksheet #4: Project Personnel Sign-Off Sheet

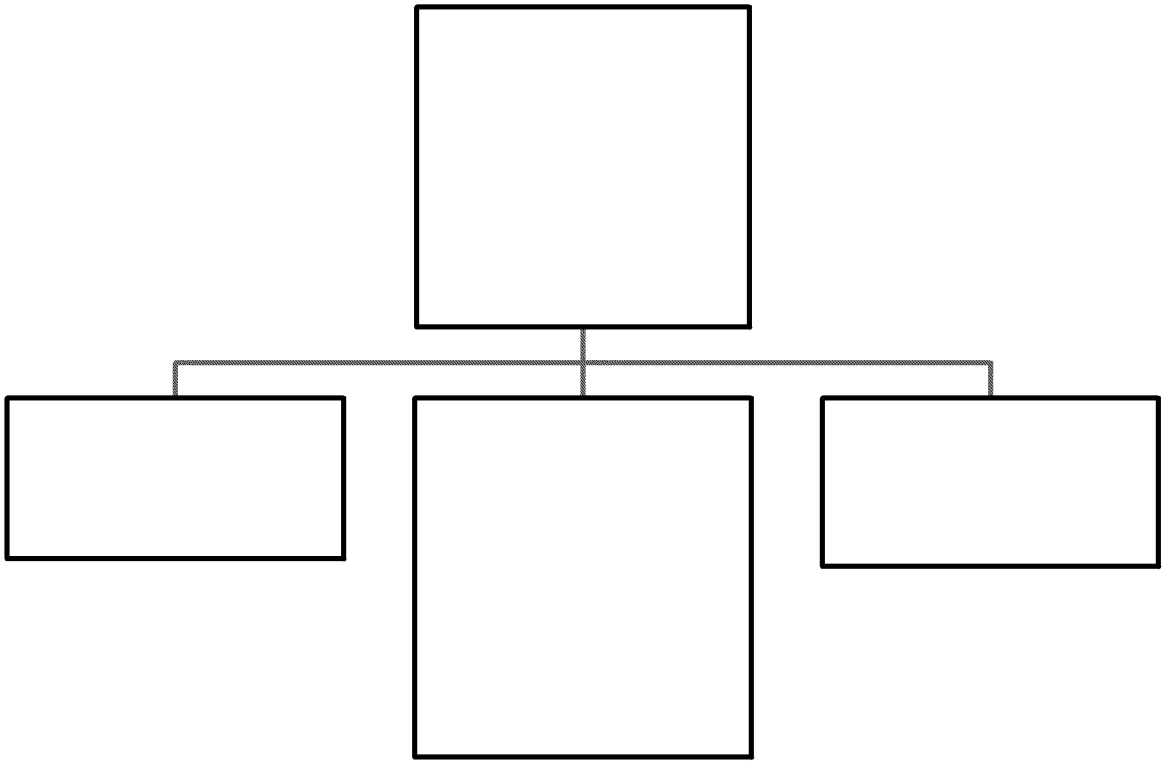
[Copies of this form signed by key project personnel from each organization to indicate that they have read the applicable sections of the site-specific QAPP and will perform the tasks as described; add additional sheets as required. Ask each organization to forward signed sheets to the central project file.]

Organization: Weston Solutions, Inc., RST 3

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Eric Daly	EPA OSC	(732) 321-4350		
Bernard Nwosu	Site Project Manager, RST 3	(732) 585-4413		
Smita Sumbaly	QAO, RST 3	(732) 585-4410		
Timothy Benton	Operations Leader / HSO, RST 3	(732) 585-4425		
Joel Petty	Field Personnel, RST 3	(732) 585-4421		
Peter Lisichenko	Field Personnel, RST 3	(732) 585-4411		
Robert Croskey	Field Personnel, RST 3	(732) 585-4412		

QAPP Worksheet #5: Project Organizational Chart

Identify reporting relationship between all organizations involved in the project, including the lead organization and all contractor and subcontractor organizations. Identify the organizations providing field sampling, on-site and off-site analysis, and data review services, including the names and telephone numbers of all project managers, project team members, and/or project contacts for each organization.



Acronyms:

SPM: Site Project Manager
HSO: Health & Safety Officer

QAPP Worksheet #6: Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Point of contact with EPA OSC	Acting Site Project Manager, Weston Solutions, Inc., RST 3	Joel Petty, Acting SPM	(732) 585-4421	All technical, QA and decision-making matters in regard to the project (verbal, written or electronic)
Adjustments to QAPP	Acting Site Project Manager, Weston Solutions, Inc., RST 3	Joel Petty, Acting SPM	(732) 585-4421	QAPP approval dialogue
Health and Safety On-Site Meeting	HSO, Weston Solutions, Inc., RST 3	Joel Petty, Acting SPM	(732) 585-4421	Explain Site hazards, personnel protective equipment, hospital location, etc.

OSC: On-Scene Coordinator
SPM: Site Project Manager
HSO: Health and Safety Officer

QAPP Worksheet #7: Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Eric Daly	EPA On-Scene Coordinator	EPA, Region II	All project coordination, direction and decision making.	NA
Joel Petty	Field Personnel, RST 3	Weston Solutions, Inc.	Acting Site Project Manager/ HSO / EPA point of contact	5+ Years
Peter Lisichenko	Field Personnel, RST 3	Weston Solutions, Inc.	Radiological survey and sample collection	10+ Years
Robert Croskey	Field Personnel, RST 3	Weston Solutions, Inc.	Radiological survey and sample collection	5+Years

*All RST 3 members, including subcontractor's resumes are in possession of RST 3 Program Manager, EPA Project Officer, and Contracting officers.

QAPP Worksheet #8: Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates[1]
[Specify location of training records and certificates for samplers]						
QAPP Training	This training is presented to all RST 3 personnel to introduce the provisions, requirements, and responsibilities detailed in the UFP QAPP. The training presents the relationship between the site-specific QA Project Plans (QAPPs), SOPs, work plans, and the Generic QAPP. QAPP refresher training will be presented to all employees following a major QAPP revision.	Weston Solutions, Inc., QAO	As needed	All RST 3 field personnel upon initial employment and as refresher training	Weston Solutions, Inc.	Weston Solutions, Inc., EHS Database
Health and Safety Training	Health and safety training will be provided to ensure compliance with Occupational Safety and Health Administration (OSHA) as established in 29 CFR 1910.120.	Weston Solutions, Inc., HSO	Yearly at a minimum	All Employees upon initial employment and as refresher training every year	Weston Solutions, Inc.	Weston Solutions, Inc., EHS Database
Others	Scribe, ICS 100 and 200, and Air Monitoring Equipment Trainings provided to all employees	Weston Solutions, Inc., QAO/Group Leader's	Upon initial employment and as needed			
	Dangerous Goods Shipping	Weston Solutions, Inc., HSO	Every 2 years			

All team members are trained in the concepts and procedures in recognizing opportunities for continual improvement, and the approaches required to improve procedures while maintaining conformance with legal, technical, and contractual obligations.

[1] All RST 3 members, including subcontractor's certifications are in possession of RST 3 HSO.

QAPP Worksheet #9: Project Scoping Session Participants Sheet

Site Name/Project Name: Niagara Falls Boulevard Site
Site Location: Niagara Falls, Niagara County, New York
Operable Unit: 00
Date of Sessions: 7/13/2015, 7/27/2015
Scoping Session Purpose: To discuss questions, comments, and assumptions regarding technical issues involved with the sampling activities.

Name	Title	Affiliation	Phone #	E-mail Address	*Project Role
Eric Daly	EPA OSC	EPA, Region II	(732) 321-4350	Daly.Eric@epa.epamail.gov	OSC
Bernard Nwosu	Site Project Manager	Weston Solutions, Inc., RST 3	(908) 565-2980	ben.nwosu@westonsolutions.com	Site Project Management/ QA Officer/ Technical Reviewer
Timothy Benton	HSO	Weston Solutions, Inc., RST 3	(732) 585-4425	tim.benton@westonsolutions.com	Health and Safety

Comments/Decisions:

As part of the Removal Assessment of the Niagara Falls Boulevard Site (the Site), Weston Solutions, Inc., Removal Support Team 3 (RST 3) has been tasked with providing support to the U.S. Environmental Protection Agency (EPA) for a ground radiological survey and subcontracting a National Radon Proficiency Program (NRPP)-certified company to conduct radon sampling at the Site. In addition, RST 3 has been tasked with collecting soil samples from locations that will be determined on-site based on results of the radiological surveys and at the discretion of the EPA On-Scene Coordinator (OSC). The radiological survey is being conducted to determine the presence or absence of radon/thoron gas and gamma radiation. The radiological survey will be conducted using a Durridge RAD7 radon/thoron detector, Ludlum-2241, Fluke Pressurized Ionization Chamber (PIC) Model 451P, Reuter-Stokes RSS-131ER High Pressure Ion Chamber (HPIC), and BNC SAM 940 gamma detectors. The radon specialist from the NRPP-certified company will provide field support in identifying radon canister placement in up to 75 locations using guidelines set forth in the American National Standards Institute (ANSI)/ American Association of Radon Scientists and Technologists (AARST) *Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings* (MAMF 2012), placing the canisters, picking up the canisters, and delivering to a private laboratory for radon analysis. Soil sampling will be conducted using Geoprobe® services and dedicated disposable scoops. Up to 21 soil samples will be collected from 20 sampling locations. A total of 20

	soil samples, including one field duplicate, will be collected from

QAPP Worksheet #9: Project Scoping Session Participants Sheet (concluded)

Comments/Decisions: on-site locations suspected to contain radionuclides and metals/metalloids and one soil sample will be collected from a location determined to be outside the site's footprint of historical activities in order to document background conditions. The soil samples will be collected to determine the concentrations of radionuclides and metals/metalloids in the soil present on the Site. Rinsate blank samples will be collected as needed to demonstrate the effectiveness of the decontamination procedure of the Geoprobe® cutting shoe. The soil and rinsate (aqueous) samples will be submitted to an RST 3-procured laboratory for target analyte list (TAL) metal, including mercury, isotopic thorium (thorium-228, thorium-230, and thorium-232), isotopic uranium (uranium-233/234, uranium-235/236, and uranium-238), radium-226, radium-228, and gamma spectroscopy analyses. The soil samples will be collected for a definitive data quality assurance/quality control (QA/QC) objective. Field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a rate of one per twenty soil samples.

Consensus Decisions: The Removal Assessment activities are scheduled to begin on August 10, 2015.

Action Items: A CLP Request Form and the RST 3 Analytical Service Request Forms were submitted by RST 3 on July 27, 2015.

QAPP Worksheet #10: Problem Definition

PROBLEM DEFINITION

Uranium (half-life of 4.5 billion years) is a naturally occurring radioactive isotope, decaying primarily by alpha emission with accompanying gamma. Uranium produces several radioactive isotopes including radium-226 (Ra-226) and radon-222 (Rn-222), which have a half-life of 1,602 years and 3.8 days, respectively. Rn-222 is a radioactive isotope which naturally forms as a gas, producing several radioactive radon decay products, including polonium-218, lead-214, bismuth-214, and polonium-214.

Thorium (half-life of 14 billion years) is a naturally occurring radioactive isotope, decaying primarily by alpha emissions with accompanying gamma. Thorium produces several radioactive isotopes, including gamma emitting actinium-228 (Ac-228), lead-212 (Pb-212), bismuth-212 (Bi-212), radium-224 (Ra-224), and thoron-220 gas (Rn-220). Ra-224 and Rn-220 have a half-life of 3.6 days and 55 seconds, respectively.

The U.S. Department of Health and Human Services' (HHS) Agency for Toxic Substances and Diseases Registry (ATSDR) has established that long-term exposure to gamma radiation poses a health risk and radon gases in air can buildup in the lungs with the potential to cause lung cancer after prolonged exposure.

A Removal Assessment is being conducted by EPA to determine the presence or absence of radon/thoron gas and gamma radiation through radiological surveys, to ascertain the concentration of radioactive gasses, specifically radon and thoron, being emitted at the Site, and to verify the presence of residual contamination and potential releases of radiation-containing material in soil associated with the Site.

SITE HISTORY/CONDITIONS

The Niagara Falls Boulevard Site (the Site), is located in a mixed commercial and residential area of Niagara Falls, New York. The Site consists of two parcels, namely 9524 and 9540 Niagara Falls Boulevard. This Site encompasses approximately 2.53 acres. Currently, the 9524 Niagara Falls Boulevard property contains a bowling alley and an asphalt parking lot and the 9540 Niagara Falls Boulevard property contains a vacant building and an asphalt parking lot. The properties are bordered to the north by a wooded area; to the east by a church; to the south by Niagara Falls Boulevard, beyond which is a residential area; and to the west by a hotel and residential area.

In 1978, the U.S. Department of Energy (DOE) conducted an aerial radiological survey of the Niagara Falls region and found more than 15 properties having elevated levels of radiation above background levels. It is believed that in the early 1960s slag from the Union Carbide facility located on 47th Street in Niagara Falls, New York was used as fill on the properties prior to paving. The Union Carbide facility processed ore containing naturally-occurring high levels of uranium and thorium to extract niobium. The slag contained sufficient quantities of uranium and thorium to be classified as a licensable radioactive source material. Union Carbide subsequently

QAPP Worksheet #10: Problem Definition (Continued)

obtained a license from the Atomic Energy Commission (AEC), now the Nuclear Regulatory Commission (NRS), and the State of New York; however, the slag had been used as fill throughout the Niagara Falls region prior to licensing. Based on the original survey and subsequent investigations, it is believed that the radioactive Union Carbide slag was deposited on the Site.

In September/October 2006 and May 2007, the New York State Department of Environmental Conservation (NYSDEC) conducted radiological surveys of the interior and exterior of both properties on several occasions using both Exploranium-135 and Ludlum 2221 detectors. With the exception of an office area and storage space at 9540 Niagara Falls Boulevard that was constructed after the original building directly on top of the asphalt parking lot, interior radiation levels were relatively low. The highest reading in the newer area was 115 microroentgen per hour (µR/hr); elsewhere throughout the building, radiation levels generally ranged between 10 µR/hr and 20 µR/hr. Exterior readings taken at waist height generally ranged between 10 µR/hr and 350 µR/hr, while the maximum reading of 600 µR/hr was recorded on contact (*i.e.,* at the ground surface). At a fenced area behind the building located at 9540 Niagara Falls Boulevard, waist-high readings ranged between 200 µR/hr and 450 µR/hr, and on-contact readings ranged between 450 µR/hr and 750 µR/hr. Elevated readings were also observed on the swath of grass between the 9524 Niagara Falls Boulevard property and the adjacent property to the west that contains a hotel, and in the marshy area beyond the parking lot behind the buildings. Two biased samples of slag were collected from locations that exhibited elevated static Ludlum detector readings: one sample was collected from an area of loose blacktop that indicated readings of 515,905 counts per minute (cpm) on the Ludlum detector, and one slag sample was collected in the marshy area that indicated readings of 728,235 cpm on the Ludlum detector.

During a reconnaissance performed by the New York State Department of Health (NYSDOH) and NYSDEC on July 9, 2013, screening activities showed radiation levels at 200 µR/hr with a hand-held pressurized ionization chamber (PIC) unit around an area of broken asphalt and 500 µR/hr from a soil pile containing slag at the Site. Readings over 600,000 cpm were recorded with a sodium iodide 2x2 scintillation detector from the soil and slag pile.

On September 10, 2013, Weston Solutions Inc., Site Assessment Team (SAT) conducted a gamma radiation screening of the 9524 Niagara Falls Boulevard property using a Ludlum 2221 Scaler Ratemeter. On December 4 and 5, 2013, further radiological survey information was obtained from the 9524 and 9540 Niagara Falls Boulevard properties, as well as the church property located further east of the two Site parcels. The highest gamma radiation screening results were recorded from the exposed soil area in the rear, northern portion of the 9540 Niagara Falls Boulevard property.

From December 5 through 7, 2013, SAT documented the areas of observed contamination at the Site. The areas of observed contamination were delineated by measuring the gamma radiation exposure rates, and determining where the gamma radiation exposure rate around the source equals or exceeds two times the gamma radiation at site-specific background rates. The areas of observed contamination are defined by site-attributable gamma radiation exposure rates, as

QAPP Worksheet #10: Problem Definition (Continued)

measured by a survey instrument held 1 meter above the ground surface, which equal or exceed two times the site-specific background gamma radiation exposure rate. At Site, an area of approximately 168,832 square feet was found to have gamma radiation levels which exceed two times the background measurement of 8,391 cpm. PIC data were also collected at several points to confirm the boundary.

On December 11, 2013, SAT collected a total of 16 soil samples, including one environmental duplicate sample, and three slag samples from 15 boreholes advanced throughout the Site and the First Assembly Church property located directly adjacent to the east/northeast of the Site property, using hollow-stem auger drilling methods. The two soil samples collected on the First Assembly Church property were to document background conditions. At each sample location, soil samples were collected directly beneath slag; at locations where slag was not present, the soil sample was collected at the equivalent depth interval. The soil samples were analyzed for target analyte list (TAL) metals, isotopic thorium, isotopic uranium, radium-226, radium-228 by alpha spectroscopy; and radioisotopes by gamma spectroscopy. The slag samples were analyzed for isotopic thorium, isotopic uranium, radium-226, radium-228 by alpha spectroscopy; and radioisotopes by gamma spectroscopy. Analytical results indicated concentrations of radionuclides found in the slag and soil to be significantly higher than at background conditions (*i.e.,* greater than 2x background concentrations).

On April 28, 2014, U.S. Environmental Protection Agency (EPA) contractor personnel collected radon and thoron concentration measurements from locations on and in the vicinity of the Site. At the selected locations in background areas, above the source material, and off the source area, radon and thoron concentration measurements in picocuries per liter (pCi/L) were collected with RAD7 radon detectors. The radon and thoron measurements were collected at heights of one meter above the ground surface. The measurements included uncertainty values, which were taken into account to calculate adjusted concentrations for evaluation of observed release in the air migration pathway. There were no radon or thoron concentrations that exceeded the site-specific background, nor were there any adjusted concentrations that equaled or exceeded a value two standard deviations above the mean site-specific background concentration for that radionuclide in that type of sample (*i.e.,* there is no evidence of an observed release to air from Site sources).

In July 2015, EPA Removal Action Branch (RAB) and Weston Solutions, Inc., Removal Support Team 3 (RST 3) personnel mobilized to the Site to conduct additional radiological delineation screening activities. The objectives of the radiological delineation activities were to determine if a Removal Action at the Site is warranted. The results of the radiological screening along with the analytical results of this phase of the assessment will assist EPA in determining the Sites eligibility.

QAPP Worksheet #10: Problem Definition (Continued)

PROJECT DESCRIPTION

RST 3 will conduct a radon/thoron survey using RAD7 and provide support to EPA for gamma survey using Ludlum-2241, Fluke Pressurized Ionization Chamber (PIC) Model 451P, Reuter-Stokes RSS-131ER High Pressure Ion Chamber (HPIC) and BNC SAM 940. RST 3 will subcontract the services of a NRPP-certified company, Accu-View Property Inspections, Inc. (AVPI), to provide field support in identifying radon canister placement in up to 75 locations, placing the canisters, picking up the canisters, and delivering to a private laboratory, Radon Testing Corporation of America (RTCA), for radon analysis. RST 3 will collect soil samples from locations suspected to contain radionuclides and metals/metalloids. Rinsate blank samples will be collected as needed to demonstrate proper decontamination procedures of the Geoprobe® cutting shoe. The soil and rinsate samples will be submitted to an RST 3-procured laboratory, Test America for TAL metal, including mercury, isotopic thorium (thorium-228, thorium-230 and thorium-232), isotopic uranium (uranium-233/234, uranium-235/236 and uranium-238), radium-226, radium-228, and gamma spectroscopy analyses.

OBSERVATION FROM ANY SITE RECONNAISSANCE REPORT

On September 10, 2013, SAT conducted a radiological survey of the Site using a Ludlum 2221 Scaler Ratemeter. Beginning at the western corner of the property at Niagara Falls Boulevard and the adjacent hotel, SAT began walking transects at 3-foot intervals measuring gamma radiation levels at waist height. Gamma readings along the grass swath between the 9524 Niagara Falls Boulevard property and the hotel property ranged from 20,000 to 30,000 cpm, and steadily increased to between 40,000 and 50,000 cpm as SAT proceeded onto the asphalt. By the time SAT reached the middle of the parking lot in front of the building, radiation levels were consistently over 100,000 cpm. Radiation levels measured on the concrete walkway directly in front of the building were generally below 20,000 cpm. Radiation levels detected while surveying the parking lot on the east side of the building adjacent to 9540 Niagara Falls Boulevard were consistently between 150,000 and 175,000 cpm, and the levels detected at the parking lot behind (i.e., north) of the building were consistently between 180,000 and 190,000 cpm. SAT surveyed an area of broken asphalt in the rear parking lot; radiation levels ranged from 200,000 to 300,000 cpm. Radiation levels along the edge of the parking lot and overgrown brush area behind the building ranged between 30,000 and 40,000 cpm. SAT also surveyed gamma radiation levels inside the building. Radiation levels at the back entrance were around 25,000 cpm. Once inside the building, levels ranged between 6,000 and 10,000 cpm. The property owner stated that the whole back area (e.g., the lockers, arcade area, and small bowling store) was raised 2 feet with concrete, and that the radiation levels inside the building in this area were greatly reduced as a result. The storage area behind the alley registered levels between 7,000 and 8,000 cpm. The side entranceway, which also had additional concrete added, had radiation levels between 10,000 and 14,000 cpm.

QAPP Worksheet #10: Problem Definition (Concluded)

PROJECT DECISION STATEMENTS

EPA will use the field measurements from the radiological surveys to determine the presence or absence of radon/thoron gas and gamma radiation, the analytical results from the radon sampling event will be used to ascertain the concentration of Radon-222 in on-site buildings, and the analytical results from the soil sampling event will be used by EPA to verify the presence of residual contamination and potential releases of radiation-containing material in soil associated with the Site.

QAPP Worksheet # 11:
Project Quality Objectives/Systematic Planning Process Statement

Overall project objectives include: To determine the presence or absence of radon/thoron gas and gamma radiation using RAD7 and PIC/Ludlum-2241 respectively; to ascertain the concentration of Ra-222 in on-site buildings utilizing the services of AVPI to provide field support in placing the canisters at up to 75 locations, picking up the canisters, and delivering to RTCA for radon analysis; and to verify the presence of residual contamination and potential releases of radiation-containing material in soil associated with the Site through soil sampling for TAL metal including mercury, isotopic thorium, isotopic uranium, radium-226, radium-228, and gamma spectroscopy analyses at an RST 3-procured laboratory, Test America.

Who will use the data? Data will be used by EPA, Region II OSC.

What will the data be used for? The analytical data from this investigation will be used to assist the EPA in determining whether a Removal Action is warranted at the Site.

What types of data are needed?
Type of Data: Quantitative data for air measurements/Definitive data for soil samples

Analytical Techniques: Field survey equipment for air/Off-site laboratory analyses for air, soil and aqueous samples

Parameters: Radon/thoron gases for air measurements quantitative for air measurements, Radon (Radon-222) for air matrix; TAL metals, including mercury, isotopic thorium (thorium-228, thorium-230 and thorium-232), isotopic uranium (uranium-233/234, uranium-235/236 and uranium-238), radium-226, radium-228, and gamma spectroscopy analysis for soil and aqueous matrices.

Type of survey/sampling equipment: RAD7 Radon Detector for air measurements, Ludlum-2241, Fluke Pressurized Ionization Chamber (PIC) Model 451P, Reuter-Stokes RSS-131ER High Pressure Ion Chamber (HPIC), and BNC SAM 940 for gamma surveys, and activated charcoal canisters for radon samples. Geoprobe®, plastic scoops, aluminum pans, and sample jars for soil.

Access Agreement: To be provided by EPA, Region II OSC.

Sampling locations: Radiological surveys will be conducted throughout the entire site using RAD7, PIC and Ludlum-2241. Radon sampling will be conducted inside on-site buildings at locations that will be determined by EPA. Soil sampling locations will be determined based on results from radiological surveys, from locations suspected to contain radionuclides and metals/metalloids and at the discretion of the EPA OSC.

QAPP Worksheet # 11:
Project Quality Objectives/Systematic Planning Process Statement (Concluded)

How much data are needed? Up to 75 radon samples, including field duplicates and field blanks, will be collected for air and up to 20 soil samples, including one field duplicate, and one background soil samples will be collected during the sampling event. In addition rinsate blank samples will be collected as needed.

How "good" does the data need to be in order to support the environmental decision? Sampling/analytical measurement performance criteria for Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters will be established. Refer to Worksheet #12, criteria for performance measurement for definitive data.

Where, when, and how should the data be collected/generated? For radon sampling, the sampling locations will be determined on-site by the EPA OSC. Canisters will be placed inside on-site buildings about 20 inches above the ground and will collect ambient air for approximately 72 hours. For soil sampling, locations will be determined based on results from radiological surveys, from locations suspected to contain radionuclides and metals/metalloids and at the discretion of the EPA OSC. All soil samples will be collected using methods outlined in the Standard Operating Procedures (SOPs). The sampling event is scheduled to begin on August 10, 2015.

Who will collect and generate the data? The radon samples will be collected by personnel from AVPI and will be analyzed by RTCA. The soil samples will be collected by RST 3 field personnel and analyzed by Test America laboratory. Radon analytical data will be reviewed and validated by RST 3 data validation personnel and soil and aqueous radiological data will be subcontracted for data validation.

How will the data be reported? All data will be reported by the assigned laboratory (Preliminary, Electronic, and Hard Copy format). The Site Project Manager will provide a Sampling Trip Report, Status Reports, Maps/Figures, Analytical Report, and Data Validation Report to the EPA OSC.

How will the data be archived? Electronic data deliverables will be archived in a Scribe database. Non-CLP data will be archived in EPA's document control room.

QAPP Worksheet #12A: Measurement Performance Criteria Table

Matrix	Air
Analytical Group	Radon
Concentratio Level	Low

Sampling Procedure	**Analytical Method/SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
ANSI/AARST MAMF 2012	EPA Method 402-R-92-014	Precision	Relative Percent Difference (RPD) of +28% warning level and 30% control limit for duplicates of 4.0 pCi/L or greater. For duplicates of less than 4.0 pCi/L, the RPD warning level is 50% and the control limit is 67%.	Laboratory Duplicates	A
		Precision	RPD – 28%	Field Duplicates	A
		Accuracy	No analyte > DL	Field Blank Verification	A
		Accuracy	± 25% of the total value.	Data Completeness	A

QAPP Worksheet #12B: Measurement Performance Criteria Table

Matrix	Soil[1]/Aqueous[2]
Analytical Group	TAL Metals + Hg
Concentration Level	Low/Medium

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP # 2012	SW846, Method 6010C and 7471B (Hg)	Precision (field)	±35 % D	Field Duplicate	S & A
		Accuracy (field)	No analyte > CRQL	Field Blank	S & A
		Precision (laboratory)	±20 % RPD (Aqueous) ±30 % RPD (Soil) 75 – 125 %	Lab Duplicate; MS/MSD	S & A
		Accuracy (Laboratory)	80 – 120 % (Aqueous) SRM Limits (Soil)	LCS	A
		Accuracy (laboratory)	No analyte > CRQL	Rinsate Blank	S & A
		Precision (laboratory)	10% RPD	Serial Dilution	A

1 Reference number from QAPP Worksheet #21 & #23
2 Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #12C: Measurement Performance Criteria Table

Matrix	Soil[1]
Analytical Group	Isotopic Thorium
Concentration Level	Low/Medium

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP # 2012	Alpha Spectrometry, HASL-300-A-01-R	Precision	% RPD < 40; RER <1%	Sample Duplicate	A
		Accuracy	Limits: Recovery Th-228: 70-130% Th-230: 81-118% Th-232: 70-130%	LCS	A
		Accuracy	< MDC	Method Blank	A

1 Reference number from QAPP Worksheet #21 & #23

QAPP Worksheet #12D: Measurement Performance Criteria Table

Matrix	Aqueous[2]
Analytical Group	Isotopic Thorium
Concentration Level	Low/Medium

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP # 2012	Alpha Spectrometry, HASL-300-A-01-R	Precision	% RPD < 40; RER <1%	Sample Duplicate	A
		Accuracy	Limits: Recovery Th-228: 70-130% Th-230: 81-125% Th-232: 70-130%	LCS	A
		Accuracy	< MDC	Method Blank	A

2 Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #12E: Measurement Performance Criteria Table

Matrix	Soil[1]
Analytical Group	Isotopic Uranium
Concentration Level	Low/Medium

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP # 2012	Alpha Spectrometry, HASL-300-A-01-R	Precision	% RPD < 40; RER <1%	Sample Duplicate	A
		Accuracy	Limits: Recovery U-234: 84-120% U-238: 82-122%	LCS	A
		Accuracy	< MDC	Method Blank	A

1 Reference number from QAPP Worksheet #21 & #23

.

QAPP Worksheet #12F: Measurement Performance Criteria Table (continued)

Matrix	Aqueous[2]
Analytical Group	Isotopic Uranium
Concentration Level	Low/Medium

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP # 2012	Alpha Spectrometry, HASL-300-A-01-R	Precision	% RPD < 40; RER <1%	Sample Duplicate	A
		Accuracy	Limits: Recovery U-234: 84-120% U-238: 83-121%	LCS	A
		Accuracy	< MDC	Method Blank	A

2 Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #12G: Measurement Performance Criteria Table (continued)

Matrix	Aqueous[2]
Analytical Group	Ra-226, and Ra-228
Concentration Level	Low/Medium

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP # 2012	SW846 9315/9320	Precision	% RPD < 40; RER <1%	Sample Duplicate	A
		Accuracy	Limits: Recovery Ra-226: 68-137% Ra-228: 56-140%	LCS	A
		Accuracy	< MDC	Method Blank	A

2 Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #12H: Measurement Performance Criteria Table

Matrix	Soil[1]
Analytical Group	Radioisotopes by Gamma Spectrometry
Concentration Level	Low/Medium

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP # 2012	Soil: Gamma Spectroscopy HASL 300 GA-01-0R	Precision	% RPD < 40; RER <1%	Duplicate	A
		Accuracy	Limits: Recovery Am-241: 87-116% Cs-137: 87-120% Co-60: 87-115%	LCS	A
		Accuracy	< MDC	Method Blank	A
		Accuracy	< MDC	Method Blank	A

1 Reference number from QAPP Worksheet #21 & #23

QAPP Worksheet #12I: Measurement Performance Criteria Table

Matrix	Aqueous[2]
Analytical Group	Radioisotopes by Gamma Spectrometry
Concentration Level	Low/Medium

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP # 2012	Soil: Gamma Spectroscopy HASL 300 GA-01-0R	Precision	% RPD < 40; RER <1%	Duplicate	A
		Accuracy	Limits: Recovery Am-241: 90-111% Cs-137: 90-111% Co-60: 89-110%	LCS	A
		Accuracy	< MDC	Method Blank	A

2 Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #13: Secondary Data Criteria and Limitations Table

Any data needed for project implementation or decision making that are obtained from non-direct measurement sources such as computer databases, background information, technologies and methods, environmental indicator data, publications, photographs, topographical maps, literature files and historical data bases will be compared to the DQOs for the project to determine the acceptability of the data. Thus, for example, analytical data from historical surveys will be evaluated to determine whether they satisfy the validation criteria for the project and to determine whether sufficient data was provided to allow an appropriate validation to be done. If not, then a decision to conduct additional sampling for the site may be necessary.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data May Be Used (if deemed usable during data assessment stage)	Limitations on Data Use
EPA Investigation	Site Inspection Report. DCN#: 2223-2A-BKYP	Weston Solutions, Inc. (SAT Region 2)	To determine possible areas of observed contamination.	Screening-level data

QAPP Worksheet #14: Summary of Project Tasks

Survey Task:

Radon/Thoron Survey: In order to determine the presence or absence of radon/thoron gas, a RAD7 electronic radon/thoron detector with a printer attachment will be utilized by RST 3 to collect field survey data. The RAD7 sampling train will consist of a 6-inch dryer tube filled with desiccant and attached to a 3-foot long vinyl tube connected to an inlet particulate filter that will plug into the RAD7 intake port. When the RAD7 is set to Sniff/Run, ambient air will flow through the desiccant-filled tube into the intake port of the RAD7. At the end of the RAD7 Sniff/Run time, the attached printer will provide hardcopy analytical results of radon/thoron concentration in air, recorded in pCi/L.

Two RAD7 units will be set up at each background/test location. For the first RAD7 unit, the 6-inch dryer tube filled with desiccant will be set at 1-inch above the ground (contact measurement) and for the second RAD7 unit, the 6-inch dryer tube filled with desiccant will be set at approximately 3 feet above the ground (waist level measurement). A background survey will be conducted prior to initiating a Sniff/Run test. Prior to conducting a 30-minute background survey "Run" test, the RAD7 will be purged for 10 minutes. Initial survey at each location will be in Sniff mode for a 10-minutes "Sniff" test. If survey results in Sniff mode equal or exceed a value two standard deviations above the mean site-specific background concentration (2x background), then a 30-minute Run will be conducted in the "Standard" mode. If after a 30-minute survey, a reading greater than 4 piC/L is obtained, other options, including potential additional survey at that location will be determined by the EPA OSC. If the reading is 5.6 piC/L (+/- 1), then the test is completed for that location if the range of the concentration is in the lower value range (4.6 piC/L), otherwise, other options will be determined on-site by the EPA OSC.

Gamma Survey: RST 3 will also delineate the area of observed contamination by measuring the gamma radiation exposure rates within the source area and at background locations. In accordance with Hazard Ranking System (HRS) requirements for naturally-occurring radionuclides, areas of observed contamination are defined by site-attributable radionuclide concentrations that equal or exceed a value two standard deviations above the mean site-specific background concentration or by gamma radiation exposure rates, measured by a survey instrument.

The presence/absence of gamma radiation will be determined by RST 3 using a PIC Model 451P and Ludlum-2241 to obtain field survey data. Using the PIC, Two instantaneous measurements from the PIC will be recorded at each location surveyed; one at contact (1 inch above the ground) and one at waist height (1 meter/3 feet above the ground). Survey time for each reading will be at least 30 seconds depending on the settling of the value. Data will be collected within grids that will be determined on-site in the areas of concern (AOCs). All the results obtained from the PIC measurements will be recorded as a range (*e.g.* 4-6 µR/hr). If very low level gamma levels are observed, a Reuter Stokes RSS-131ER HPIC will be utilized to determine the exact levels. A Ludlum-2241 with a sodium iodide gamma scintillator attached to it will be used to perform gross gamma survey. The sodium iodide gamma scintillator will be held approximately 6 inches above the ground when collecting measurements. A mobile survey

which will require the user to walk the Site along pre-determined paths will be performed. The

QAPP Worksheet #14: Summary of Project Tasks (Continued)

highest and lowest readings from the Ludlum will be recorded for approximately 60 seconds in cpm.

Sampling Tasks:

Radon-222 Sampling: In order to ascertain the concentration of Radon-222 in on-site buildings, RST 3 will utilize the services of AVPI in canister (Activated Charcoal Canisters) placement at up to 75 locations in accordance with the guidelines set forth in the ANSI/AARST *Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings* (MAMF 2012) and as directed by EPA. Canisters will be raised above the ground approximately 20 inches, away from drafts or vents. The canisters will collect ambient air for a minimum of approximately 72 hours at each location. For each sampling event, weather information including, temperature, humidity, wind speed, and wind direction will be recorded. The radon canister samples will be analyzed for radon gas by RTCA via EPA Method 402-R-92-014.

Soil Sampling: In order to verify the presence of residual contamination and potential releases of radiation-containing material in on-site soils, RST 3 will collect eight soil samples from seven sampling locations. Seven of the soil samples, including one field duplicate, will be collected from six on-site locations and one background soil sample will be collected from a location outside of historic site activities. The sampling locations will be determined in the field based on field survey data from RAD7, PIC and Ludlum-2241 measurements and at the discretion of the EPA OSC. Using a Geoprobe®, a soil core will be obtained from 0-4 feet bgs at each proposed soil sampling location. The sample collection depth will be decided in the field and will be selected by screening every 6-inch interval of the 4-foot core with a Ludlum-2241 gamma detector. A 6-inch soil sample will be selected where the highest levels of gamma radiation are found in the 4-foot core.

Soil samples will be obtained using dedicated disposable plastic scoops and placed in plastic Ziploc® bags. The soil samples will be homogenized in the Ziploc® bag before being placed into glass sample jars. Rinsate blank samples will be collected as needed to demonstrate proper decontamination procedure of the Geoprobe® cutting shoe. The soil and aqueous samples will be analyzed by Test America for TAL metals analysis (including mercury) via SW846 Methods 6010C/7471B; isotopic thorium (thorium-228, thorium-230 and thorium-232) and isotopic uranium (uranium-233/234, uranium-235/236 and uranium-238) via alpha spectroscopy Health and Safety Laboratory (HASL)-300-A-01-R, and Radium-226, Radium-228 and radioisotopes via gamma spectroscopy HASL-300-GA-01-R.

QAPP Worksheet #14: Summary of Project Tasks (Continued)

Decontamination:

Decontamination of non-disposable sampling equipment, including Geoprobe® cutting shoes, will be performed before and after the sampling event and between sample locations, and will consist of the following steps:

1. Soap and water scrub.
2. Tap water or deionized (DI) water rinse.
3. Steam-clean with DI water.
4. Air dry.
5. Screen with radiation meter for residual contamination.
6. Foil wrap if not immediately re-used.

The decontamination fluid will be discarded at locations that indicate the highest levels of contamination (based on radiation meter screening) such that runoff will not occur.

Analysis Tasks:

Radon will be analyzed via activated charcoal canisters (ANSI/AARST MAMF 2012), EPA Method 402-R-92-014. The soil and aqueous samples will also be analyzed by Test America for TAL metals analysis (including mercury) via SW846 Method 6010C/7471B; isotopic thorium (thorium-228, thorium-230 and thorium-232) and isotopic uranium (uranium-233/234, uranium-235/236 and uranium-238) via alpha spectroscopy Health and Safety Laboratory (HASL)-300-A-01-R, and Radium-226, Radium-228 and radioisotopes via gamma spectroscopy HASL-300-GA-01-0R.

Quality Control Tasks:

All matrices will have QC samples collected (i.e. field duplicates). All analytical methods will perform: Initial calibration, 10% laboratory duplicates; 59% field blank, monthly spike recovery, and all other applicable QC defined in the method.

Data Management Tasks:

Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports.

The following deliverables will be provided under this project:

Trip Report: A trip report will be prepared to provide a detailed accounting of what occurred

during each sampling mobilization. The trip report will be prepared within two weeks of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations).

QAPP Worksheet #14: Summary of Project Tasks (Continued)

Maps/Figures: Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

Analytical Report: An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Data Review: A review of the data generated under this plan will be undertaken. The assessment of data acceptability or usability will be provided separately, or as part of the analytical report.

Documentation and Records:

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

Field Logbook: The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. Field logbook will be bound and paginated. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Sample and sample location identification and description*
9. Subcontractor information and names of on-site personnel
10. Date and time of sample collections, along with chain of custody information
11. Record of photographs
12. Site sketches

* The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

Sample Labels: Sample labels will clearly identify the particular sample, and should include the following:

1. Site/project number.
2. Sample identification number.

3. Sample collection date and time.
4. Designation of sample (grab or composite).
5. Sample preservation.
6. Analytical parameters.
7. Name of sampler.

QAPP Worksheet #14: Summary of Project Tasks (Concluded)

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured.

Custody Seals: Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

Custody Seals: Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

Assessment/Audit Tasks: No performance audit of field operations is anticipated at this time. If conducted, performance and system audit will be in accordance with the project plan.

Data Review Tasks: All data will be validated by RST 3 (RST 3-procured laboratory data).

Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

QAPP Worksheet #15A: Reference Limits and Evaluation Table

Matrix: Air
Analytical Group: Radon
Concentration Level: Low

Analyte	Project Action Limit (pCi/L)	Project QL (pCi/L)	Laboratory Achievable DL
Radon	4.0	--	0.5 pCi/L

QAPP Worksheet #15B: Reference Limits and Evaluation Table

Analyte	CAS Number	Project Quantitation Limit	Method CRQLs (ug/L)	Achievable Laboratory (TestAmerica) Limits			
				RLs (mg/kg)	MDLs (mg/kg)	RLs (ug/L)	MDLs (ug/L)
Aluminum	7429-90-5	NS	NS	20.0	4.26	200	22.4
Antimony	7440-36-0	NS	NS	1.00	0.309	10.0	3.74
Arsenic	7440-38-2	NS	NS	1.00	0.236	10.0	1.78
Barium	7440-39-3	NS	NS	5.00	0.110	50.0	2.12
Beryllium	7440-41-7	NS	NS	0.500	0.0750	5.00	0.283
Cadmium	7440-43-9	NS	NS	0.500	0.0340	5.00	0.336
Calcium	7440-70-2	NS	NS	250	6.73	1000	54.2
Chromium	7440-47-3	NS	NS	1.00	0.138	10.0	3.35
Cobalt	7440-48-4	NS	NS	5.00	0.144	50.0	2.72
Copper	7440-50-8	NS	NS	2.50	0.245	25.0	2.10
Iron	7439-89-6	NS	NS	10.0	1.99	100	12.8
Lead	7439-92-1	NS	NS	1.00	0.129	10.0	0.598
Magnesium	7439-95-4	NS	NS	100	3.16	1000	50.5
Manganese	7439-96-5	NS	NS	1.00	0.0800	15.0	1.00
Nickel	7440-02-0	NS	NS	4.00	0.116	40.0	2.57
Potassium	7440-09-7	NS	NS	500	72.4	5000	456
Selenium	7782-49-2	NS	NS	1.50	0.206	15.0	2.08
Silver	7440-22-4	NS	NS	1.00	0.0700	10.0	0.994
Sodium	7440-23-5	NS	NS	100	7.62	1000	105
Thallium	7440-28-0	NS	NS	2.00	0.190	20.0	2.38
Vanadium	7440-62-2	NS	NS	5.00	0.507	50.0	4.39
Zinc	7440-66-6	NS	NS	5.00	0.562	20.0	8.32
Mercury	7439-97-6	NS	NS	0.0330	0.0110	0.200	0.0600

NS – Not Specified

QAPP Worksheet #15C: Reference Limits and Evaluation Table

*Analyte	CAS Number	Project Quantitation Limit	Method CRQLs (pCi/g)	Achievable Laboratory (TestAmerica) Limits Target Soil MDCs (pCi/g)	Achievable Laboratory (TestAmerica) Limits Target Aqueous MDCs (pCi/L)
Uranium-233/234	13966-29-5	NS	NS	1.00	1.00
Uranium-235/236	15117-96-1	NS	NS	1.00	1.00
Uranium-238	7440-61-1	NS	NS	1.00	1.00
Thorium-228	14274-82-9	NS	NS	1.00	1.00
Thorium-230	14269-63-7	NS	NS	1.00	1.00
Thorium-232	7440-29-1	NS	NS	1.00	1.00

NS – Not Specified

**Analyte	CAS Number	Project Quantitation Limit	Method CRQLs (pCi/L)	Achievable Laboratory (TestAmerica) Limits Target Soil MDCs (pCi/g)	Achievable Laboratory (TestAmerica) Limits Target Aqueous MDCs (pCi/L)
Radium-226	13982-63-3	NS	NS	1.00	1.00
Radium-228	15262-20-1	NS	NS	1.00	1.00
Americium-241	14596-10-2	NS	NS	-	-
Cesium-137	10045-97-3	NS	NS	0.20	20.0
Cobalt-60	10198-40-0	NS	NS	-	-

NS – Not Specified

QAPP Worksheet #16: Project Schedule/Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Preparation of QAPP	RST 3 Contractor Site Project Manager	Prior to sampling date	8/5/2015	QAPP	8/7/2015
Review of QAPP	RST 3 Contractor QAO and/or Group Leader	Prior to sampling date	8/6/2015	Approved QAPP	8/7/2015
Preparation of Health and Safety Plan	RST 3 Contractor Site Project Manager	Prior to sampling date	8/5/2015	HASP	8/7/2015
Procurement of Field Equipment	RST 3 Contractor Site Project Manager and/or Equipment Officer	Prior to sampling date	8/7/2015	-	-
Laboratory Request	Not Applicable	Prior to sampling date	8/7/2015	CLP/Non-CLP Request Form	NA
Field Reconnaissance/Access	RST 3 Contractor Site Project Manager; or EPA Region II OSC	8/10/2015	8/10/2015	NA	NA
Collection of Field Samples	RST 3 Contractor Site Project Manager	8/10/2015	8/14/2015	NA	NA
Laboratory Electronic Data Received	RST 3 Contractor and EPA Region 2 DEWSA	8/14/2015	8/28/2015	Preliminary Data	8/28/2015
Laboratory Package Received	RST 3 Contractor and EPA Region 2 DEWSA	8/28/2015	9/4/2015	Validated Data	9/4/2015
Validation of Laboratory Results	RST 3 Contractor and EPA Region 2 DEWSA	9/4/2015	9/18/2015	Final Report	9/18/2015
Data Evaluation/ Preparation of Final Report	RST 3 Contractor Site Project Manager	9/18/2015	10/2/2015	Final Report	10/2/2015

QAPP Worksheet #17: Sampling Design and Rationale

In order to determine the presence or absence of radon/thoron gas, RAD7 electronic radon/thoron detector with a printer attachment will be utilized by RST 3 to collect field survey data. Two RAD7 units will be set up at each background/test location. For the first RAD7 unit, the 6-inch dryer tube filled with desiccant will be set at 1-inch above the ground (contact measurement) and for the second RAD7 unit, the 6-inch dryer tube filled with desiccant will be set at approximately 3 feet above the ground (waist level measurement). A background survey will be conducted prior to initiating a Sniff/Run test. Prior to conducting a 30-minute background survey "Run" test, the RAD7 will be purged for 10 minutes. Initial survey at each location will be in Sniff mode for a 10-minutes "Sniff" test. If survey results in Sniff mode equal or exceed a value two standard deviations above the mean site-specific background concentration (2x background), then a 30-minute Run will be conducted in the "Standard" mode. If after a 30-minutes survey, a reading greater than 4 piC/L is obtained, other options, including potential additional survey at that location will be determined by the EPA OSC. If the reading is 5.6 piC/L (+/- 1), then the test is completed for that location if the range of the concentration is in the lower value range (4.6 piC/L), otherwise, other options will be determined on-site by the EPA OSC.

The presence/absence of gamma radiation will be determined by RST 3 using a PIC Model 451P and Ludlum-2241 to obtain field survey data. Using the PIC, Two instantaneous measurements from the PIC will be recorded at each location surveyed; one at contact (1 inch above the ground) and one at waist height (1 meter/3 feet above the ground). Survey time for each reading will be at least 30 seconds depending on the settling of the value. Data will be collected within grids that will be determined on-site in the areas of concern (AOCs). All the results obtained from the PIC measurements will be recorded as a range (*e.g.* 4-6 µR/hr). If very low level gamma levels are observed, a Reuter Stokes RSS-131ER HPIC will be utilized to determine the exact levels. A Ludlum-2241 with a sodium iodide gamma scintillator attached to it will be used to perform gross gamma survey. The sodium iodide gamma scintillator will be held approximately 6 inches above the ground when collecting measurements. A mobile survey which will require the user to walk the Site along pre-determined paths will be performed. The highest and lowest readings from the Ludlum will be recorded for approximately 60 seconds in cpm.

In order to ascertain the concentration of Radon-222 in on-site buildings, RST 3 will utilize the services of AVPI in canister (Activated Charcoal Canisters) placement at up to 75 locations in accordance with the guidelines set forth in the ANSI/AARST *Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings* (MAMF 2012) and as directed by EPA. Canisters will be raised above the ground approximately 20 inches, away from drafts or vents. The canisters will collect ambient air for a minimum of approximately 72 hours at each location. For each sampling event, weather information including, temperature, humidity, wind speed, and wind direction will be recorded. The radon canister samples will be analyzed for radon gas by RTCA via EPA Method 402-R-92-014.

In order to verify the presence of residual contamination and potential releases of radiation-containing material in on-site soils, RST 3 will collect eight soil samples from seven sampling locations. Seven of the soil samples, including one field duplicate, will be collected from six on-

QAPP Worksheet #17: Sampling Design and Rationale (Concluded)

site locations and one background soil sample will be collected from a location outside of historic site activities. The sampling locations will be determined in the field based on field survey data from RAD7, PIC and Ludlum-2241 measurements and at the discretion of the EPA OSC. Using a Geoprobe®, a soil core will be obtained from 0-4 feet bgs at each proposed soil sampling location. The sample collection depth will be decided in the field and will be selected by screening every 6-inch interval of the 4-foot core with a Ludlum-2241 gamma detector. A 6-inch soil sample will be selected where the highest levels of gamma radiation are found in the 4-foot core.

Soil samples will be obtained using dedicated disposable plastic scoops and placed in plastic Ziploc® bags. The soil samples will be homogenized in the Ziploc® bag before being placed into glass sample jars. Rinsate blank samples will be collected as needed to demonstrate proper decontamination procedure of the Geoprobe® cutting shoe. The soil and aqueous samples will be analyzed by Test America for TAL metals analysis (including mercury) via SW846 Methods 6010C/7471B; isotopic thorium (thorium-228, thorium-230 and thorium-232) and isotopic uranium (uranium-233/234, uranium-235/236 and uranium-238) via alpha spectroscopy Health and Safety Laboratory (HASL)-300-A-01-R, and Radium-226, Radium-228 and radioisotopes via gamma spectroscopy HASL-300-G1A-01-R.

Soil sampling will be conducted as per EPA ERT Standard Operating Procedure (SOP) 2001 for General Field Sampling Guidelines. Additionally, soil samples will be collected in accordance with EPA ERT SOP 2012 for Soil Sampling.

The following laboratories will provide the analyses indicated:

Lab Name/Location	Sample Type	Parameters
Accu-View Property Inspections, Inc. PO Box 641 Buffalo, New York 14051	Air	Deploy and Retrieve Canisters for Radon Testing
Radon Testing Corporation of America 2 Hayes Street Elmsford, New York 10523	Air	Radon Testing
TestAmerica 13715 Rider Trail North St. Louis, MO 63045	Soil	TAL Metals + Hg via SW846, Method 6010C/7471B
		Isotopic Thorium and Isotopic Uranium by HASL alpha spectroscopy
		Radium-226, Radium-228 and radioisotopes by gamma spectroscopy via HASL-300 or equivalent

Refer to Worksheet #20 for QA/QC samples, sampling methods, and SOPs.

QAPP Worksheet #18: Sampling Locations and Methods/SOP Requirements Table

Matrix	Sampling Location(s)	Units	Analytical Group(s)	Concentration Level	No. of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Air	75	pCi/L	Radon	Low	10% of total	SOP# 2001	Determine contaminants
Soil	20	mg/kg	TAL Metals + Hg	Low/Medium	1/20 duplicate sample per matrix	SOP# 2001 2012	Determine contaminants
Soil	20	pCi/g	Isotopic Thorium and Isotopic Uranium, by alpha spectroscopy	Low/Medium	1/20 duplicate sample per matrix	SOP# 2001 2012	Determine contaminants
Soil	20	pCi/g	Radium-226, Radium-228 and Radioisotopes by gamma spectroscopy	Low/Medium	1/20 duplicate sample per matrix	SOP# 2001 2012	Determine contaminants

The website for EPA-ERT SOPs is: http://www.ert.org/mainContent.asp?section=Products&subsection=List

QAPP Worksheet #19: Analytical SOP Requirements Table

Matrix	No. of Samples	Analytical Group	Concentration Level	Analytical / Preparation Method SOP Reference[1]	Containers (number, size, and type)	Sample volume[3] (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[2] (preparation / analysis)
Air	75	Radon	Low	EPA Method 402-R-92-014 ANSI/AAST MAMF 2012	Activated Charcoal Canister	72 hour period of time	None	None
Soil	21	Gamma Spectroscopy	Low/Medium	HASL 300 GA-01-0R SOP ST-RD-0102	1x32oz Plastic or Zip Lock bag	350g	None	None
Soil	21	Isotopic Thorium	Low/Medium	HASL 300 A-01-R SOP ST-RC-0210	1x2oz Glass Jar	5g	None	None
Soil	21	Isotopic Uranium	Low/Medium	HASL 300 A-01-R SOP ST-RC-0210	1x2oz Glass Jar	5g	None	None
Soil	21	TAL Metals	Low/Medium	SW846 3050B/6010C ST-MT-0003	1x2oz Glass Jar	1g	Cool $\leq$ 6°C	180 days
Soil	21	Mercury	Low/Medium	SW846 7471B ST-MT-0007	1x2oz Glass Jar	1g	Cool $\leq$ 6°C	28 days

[1] Refer to the Analytical SOP References table (Worksheet #23).

[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

[3] The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory Matrix Spike/Matrix Spike Duplicate sample analysis.

QAPP Worksheet #19: Analytical SOP Requirements Table (Concluded)

Matrix	No. of Samples	Analytical Group	Concentration Level	Analytical / Preparation Method SOP Reference[1]	Containers (number, size, and type)	Sample volume[3] (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[2] (preparation / analysis)
Aqueous	2	Gamma Spectroscopy	Low/Medium	HASL 300 GA-01-0R SOP ST-RD-0102	1L Plastic	1 Liter	HNO3, Cool to 4^0 C	None
Aqueous	2	Isotopic Thorium	Low/Medium	HASL 300 A-01-R SOP ST-RC-0210	1L Plastic	500 mL	HNO3, Cool to 4^0 C	None
Aqueous	2	Isotopic Uranium	Low/Medium	HASL 300 A-01-R SOP ST-RC-0210	1L Plastic	500 mL	HNO3, Cool to 4^0 C	None
Aqueous	2	Radium-226	Low/Medium	SW846 9315 SOP ST-RC-0403	1L Plastic	500 mL	HNO3, Cool to 4^0 C	None
Aqueous	2	Radium-228	Low/Medium	SW846 9320 SOP ST-RC-0403	1L Plastic	500 mL	HNO3, Cool to 4^0 C	None
Aqueous	2	TAL Metals	Low/Medium	SW846 3050B/6010C ST-MT-0003	500 mL Plastic	50 mL	HNO3, Cool to 4^0 C	180 days
Aqueous	2	Mercury	Low/Medium	SW846 7471B ST-MT-0005	500 mL Plastic	30 mL	HNO3, Cool to 4^0 C	28 days

[1] Refer to the Analytical SOP References table (Worksheet #23).

[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

[3] The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory Matrix Spike/Matrix Spike Duplicate sample analysis.

QAPP Worksheet #20: Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples[1]	No. of Field Blanks[1]	No. of Trip. Blanks	No. of PE Samples
Air	Radon	Low	EPA Method 402-R-92-014 ANSI/AAST MAMF 2012	75	10% of total	NR	NR	5%	NR
Soil	TAL Metals + Hg	Low/Medium	SW846 6010C/ 7471B ST-MT-0003, ST-MT-0007	20	1 per 20 samples	1 per 20 samples	NR	NR	NR
	Isotopic Thorium and Isotopic Uranium, by alpha spectroscopy	Low/Medium	HASL 300 A-01-R SOP ST-RC-0210	20	1 per 20 samples	1 per 20 samples	NR	NR	NR
	Radium-226, Radium-228 and Radioisotopes by gamma spectroscopy	Low/Medium	HASL 300 GA-01-0R SOP ST-RD-0102	20	1 per 20 samples	1 per 20 samples	NR	NR	NR

MS/MSD not required for radon (air) samples.
NR – Not Required
[1] Only required if non-dedicated sampling equipment to be used.

QAPP Worksheet #21: Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP#2001	General Field Sampling Guidelines (all media); Rev. 0.0 August 1994	EPA/OSWER/ERT	Site Specific	N	--
ANSI/AARST MAMF 2012	*Protocol for Conducting Radon and Radon Decay Product Measurements In Multifamily Buildings,* 2012	U.S. EPA	Charcoal Canisters	N	--
SOP #2012	Soil Sampling; Rev. 0.0 February 2000	EPA/OSWER/ERT	plastic scoops, aluminum trays, and appropriate sample jars	N	--
SOP#2050	Geoprobe; Rev.0.1 March 2002	EPA/OSWER/ERT	Downhole tooling	N	--

See attachment B for SOP # 2001 and EPA 402-R-92-014
www.ert.org/mainContent.asp?section=Products&subsection=List

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection Table

*Field Equipment
Trimble® GeoXT™ handheld, Ludlum-2241, Fluke Pressurized Ionization Chamber (PIC) Model 451P, Reuter-Stokes RSS-131ER High Pressure Ion Chamber (HPIC) and BNC SAM 940

* All on-site field equipment will be provided and operated by the EPA.

QAPP Worksheet #23: Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
ANSI/AARST MAMF 2012	Radon Analysis, via activated charcoal canisters	Definitive Data	Radon	Gamma Spectroscopy	RTCA – Elmsford, NY	N
ST-MT-0003	Analysis of Metals by Inductively Coupled-Atomic Emission Spectroscopy Rev. 17, 06/22/15	Definitive	Soil and Aqueous - TAL Metals	ICP	TestAmerica –St. Louis, MO	N
ST-MT-0007	Preparation and Analysis of Mercury in Soil by CVAA, Rev. 14, 08/25/14	Definitive	Soil - Mercury	Cold Vapor AA	TestAmerica – St. Louis, MO	N
ST-MT-0005	Preparation and Analysis of Mercury in Aqueous Samples by CVAA, Rev. 15, 08/25/14	Definitive	Water/ Mercury	Cold Vapor AA	TestAmerica –St. Louis	N
ST-RD-0102	GammaVision Analysis, Rev. 13, 06/22/2015	Definitive	Soil and Aqueous - Gamma Spec	Gamma Spectroscopy	TestAmerica – St. Louis, MO	N
ST-RD-0210	Alpha Spectroscopy Analysis, Rev. 12, 04/24/02015	Definitive	Soil and Aqueous - Isotopic Uranium & Isotopic Thorium	Alpha Spectroscopy	TestAmerica – St. Louis, MO	N
ST-RD-0403	Low Background Gas Flow Proportional Counting (GFPC) System Analysis, Rev. 16, 05/05/2015	Definitive	Aqueous / Radium-226 & Radium-228	Gas Flow Proportional Counter	TestAmerica –St. Louis	N

QAPP Worksheet #24: Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for CA	SOP Reference[1]
ICP-AES	Linear Dynamic Range (LDR) or high-level check standard	At initial set up and checked every 6 months high a high standard at the upper limit of the range	Within + 10% of true value	Dilute samples within the calibration range, or re-establish/verify the LDR	TestAmerica – St. Louis Analyst	ST-MT-0003
ICP-AES	Initial Calibration (ICAL) – minimum one high standard and a calibration blank	Daily initial calibration prior to sample analysis	If more than one calibration standard is used, r2 ≥ 0.99	Recalibrate	TestAmerica – St. Louis Analyst	ST-MT-0003
ICP-AES	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Correct problem. Rerun ICV. Repeat ICAL as necessary.	TestAmerica – St. Louis Analyst	ST-MT-0003
ICP-AES	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within ± 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica – St. Louis Analyst	ST-MT-0003
ICP-AES	Low-level Calibration Check Standard (Low-level ICV)	Daily	All analytes within + 20% of expected value	Correct problem and repeat ICAL	TestAmerica – St. Louis Analyst	ST-MT-0003
ICP-AES	Interference Check Solutions (ICS)	After ICAL and prior to sample analysis	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOD(unless they are a verified trace impurity from one of the spike analytes) ICS-AB: within + 20% of true value	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples	TestAmerica – St. Louis Analyst	ST-MT-0003

QAPP Worksheet #24: Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for CA	SOP Reference[1]
Cold Vapor AA	Initial Calibration (ICAL)	Daily initial calibration prior to sample analysis	Correlation coefficient R>=0.995 for linear regression	Recalibrate	TestAmerica – St. Louis Analyst	ST-MT-0007
Cold Vapor AA	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected value (second source)	Recalibrate	TestAmerica – St. Louis Analyst	ST-MT-0007
Cold Vapor AA	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence.	All analytes within + 20% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica – St. Louis Analyst	ST-MT-0007
Gamma Spectrometer	1. Energy calibration 2. FWHM calibration 3. Background	1. Annual 2. Annual 3. Monthly	For Energy and FWHM calibration: • Within 0.5% or 0.1 KeV for all calibration points • Within 8% for all calibration points • Verify with second source that always contains at least Am-241, Co-60, and Cs-137 • Must be ± 10%D for each nuclide For Background, acceptance criterion is 12 hours	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica – St. Louis Group Leader	ST-RD-0102
Alpha Spectrometer	1. Energy calibration 2. Efficiency calibration and background check 3. Subtraction spectrum 4. Pulser check and background check	1. Monthly 2. Monthly 3. Monthly 4. Daily	1. Three isotopes in 3–6 MeV range all within ± 40 KeV of expected value 2. >20% 3. Ultra Low Level: < 2 CPM Low Level: < 2–4 CPM Routine Level: < 4–10 CPM High Level: < 10–20 CPM 4. Pulser energy, peak centroid, peak resolution, peak area, calibration and background must pass statistical "boundary" out-of-range test	• Recalibrate • Instrument maintenance • Consult with Technical Director • If background check is > 20 CPM, then detector requires maintenance	TestAmerica – St. Louis Group Leader	ST-RC-0210

QAPP Worksheet #24: Analytical Instrument Calibration Table (Concluded)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for CA	SOP Reference[1]
Gas Flow Proportional Counter	• Plateau generation and/or verification • Discriminator setting • Initial long background count • Mass attenuated efficiency calibration • Eight source dual/single calibration curves	Annual	• Plot efficiencies vs masses • Calculate equation of curve – degree ≤3 • Remove outliers >15% deviation from theoretical values but not more than 20% of total points • Calculate coefficient of determination (R^2). R^2 must be ≥0.9 • Verify calibration with second source standard count – must be within 30 percent of true value and mean across all detectors <10%	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica – St. Louis Group Leader	ST-RD-0403

[1] Specify the appropriate letter or number form the Analytical SOP References table (Worksheet #23)
CA – corrective action
DESA – Division of Environmental Science and Assessment
EPA – U.S. Environmental Protection Agency
ICP-AES – inductively coupled plasma atomic emission spectroscopy
SOP – standard operating procedure

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
ICP-AES	ICS	Instrument Performance	Conformance to interference check	Prior to sample analysis	Within + 20% of expected value	Terminate analysis, reanalyze ICS to rule out standard degradation or inaccurate injection. If problem persists, perform instrument maintenance, repeat calibrations and reanalyze all associated samples.	TestAmerica – St. Louis Analyst	ST-MT-0003
ICP-AES	ICB/CCB	Instrument Performance	Instrument contamination check	After every calibration verification	ICB:No analytes detected > RL; CCB: no analyte detected > 3X MDL	Determine possible source of contamination and apply appropriate measure to correct the problem. Reanalyze calibration blank and all associated samples.	TestAmerica – St. Louis Analyst	ST-MT-0003
Cold Vapor AA	ICB/CCB	Instrument Performance	Instrument contamination check	After every calibration verification	No analytes detected > RL	Determine possible source of contamination and apply appropriate measure to correct the problem. Reanalyze calibration blank and all associated samples.	TestAmerica – St. Louis Analyst	ST-MT-0007
Gamma Spectrometer	1. Clean cave; fill dewar with N_2 2. QA check	1. Physical check 2. Background and source check	1. Physical check 2. Check deviation	1. Weekly 2. Daily	1. Acceptable background 2. Within 3 sigma of measured population	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica – St. Louis Group Leader / Analyst	ST-RD-0102

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Concluded)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Alpha Spectrometer	Clean planchette holders	Physical check	Physical check	Monthly	Acceptable background and calibration efficiencies	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica – St. Louis Group Leader / Analyst	ST-RC-0210
Gas Flow Proportional Counter	1. Clean instrument 2. Inspect windows 3. QA check	1. Physical check 2. Physical check 3. Background and source count	1. Physical check 2. Physical check 3. Check deviation	1. Daily 2. High counts and/or background 3. Daily	1. None applicable 2. No physical defects 3. Within 3 sigma of 20 day population	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica – St. Louis Group Leader / Analyst	ST-RD-0403

[1] Specify the appropriate letter or number form the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #26: Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): RST 3 Site Project Manager, Weston Solutions, Inc., Region II
Sample Packaging (Personnel/Organization): RST 3 Site Project Manager and sampling team members, Weston Solutions, Inc., Region II
Coordination of Shipment (Personnel/Organization): RST 3 Site Project Manager, sampling team members, Weston Solutions, Inc., Region II
Type of Shipment/Carrier: FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodian, RST 3-Procured Non-RAS Laboratory
Sample Custody and Storage (Personnel/Organization): Sample Custodian, RST 3-Procured Non-RAS Laboratory
Sample Preparation (Personnel/Organization): Sample Custodian, RST 3-Procured Non-RAS Laboratory
Sample Determinative Analysis (Personnel/Organization): Sample Custodian, RST 3-Procured Non-RAS Laboratory
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples to be shipped same day of collection, and arrive at laboratory within 24 hours (1 day) of sample shipment
Sample Extract/Digestate Storage (No. of days from extraction/digestion): As per analytical methodology; see Worksheet #19
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian, RST 3-Procured Non-RAS Laboratory
Number of Days from Analysis: Until analysis and QA/QC checks are completed; as per analytical methodology; see Worksheet #19.

QAPP Worksheet #27: Sample Custody Requirements

Sample Identification Procedures Each sample collected by Region II RST 3 will be identified by a property number (N001), a sample location number (001), the matrix identifier of the sample collected (AA for radon air sample and SS for soil sample), specifically for soil samples, the depth interval from where the sample was collected will be identified as a range (0612), and the sample number (01). The last number will represent the sample number collected from each location. Duplicate samples will be identified in the same manner but will be the next sequential sample number (in most cases 02).

e.g. N001-AA002-01; whereas, N001 = Property Number 001, AA001 = Radon Sample Location 002, 01 = Sample Number 01.
e.g. N001-SS002-0612-01: whereas, N001 = Property Number 001, SS001 = Soil Sample Location 002, 0612 = Soil sample collected at 6 to 12 feet, 01 = Sample Number 01

Location of the sample collected will be recorded in the project database and site logbook. A duplicate sample will be identified in the same manner as other samples and will be distinguished and documented in the field logbook. Each sample will also be labeled with a non-CLP assigned number. Depending on the type of sample, additional information such as sampling round, date, etc. will be added.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Each sample will be individually identified and labeled after collection, then sealed with custody seals and enclosed in a plastic cooler. The sample information will be recorded on chain-of custody (COC) forms, and the samples shipped to the appropriate laboratory via overnight delivery service or courier. Chain-of-custody records must be prepared in Scribe to accompany samples from the time of collection and throughout the shipping process. Each individual in possession of the samples must sign and date the sample COC Record. The chain-of-custody record will be considered completed upon receipt at the laboratory. A traffic report and chain-of-custody record will be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook. The chain-of-custody record should include (at minimum) the following: 1) Sample identification number; 2) Sample information; 3) Sample location; 4) Sample date; 5) Sample Time; 6) Sample Type Matrix; 7) Sample Container Type; 8) Sample Analysis Requested; 9) Name(s) and signature(s) of sampler(s); and 10) Signature(s) of any individual(s) with custody of samples.

A separate chain-of-custody form must accompany each cooler for each daily shipment. The chain-of-custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

QAPP Worksheet #27: Sample Custody Requirements (Concluded)

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): A sample custodian at the laboratory will accept custody of the shipped samples, and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory manager for corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. At this time, no samples will be archived at the laboratory. Disposal of the samples will occur only after analyses and QA/QC checks are completed.

QAPP Worksheet #28A: QC Samples Table
Radon

Matrix	Air
Analytical Group	Radon
Concentration Level	Low
Sampling SOP(s)	See QAPP Worksheet #18
Analytical Method/SOP Reference	ANSI/AARST MAMF 2012 / EPA Method 402-92-R-014
Sampler's Name	Richard F. Pezzino
Field Sampling Organization	Accu-View Property Inspections, Inc.
Analytical Organization	Radon Testing Corporation of America
No. of Sample Locations	75

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Lab Duplicate	10% of the sample	EPA Method 402-R-92-014	Identify problem and correct	Laboratory technician	Precision	Relative Percent Difference (RPD) of +28% warning level and 30% control limit for duplicates of 4.0 pCi/L or greater. For duplicates of less than 4.0 pCi/L, the RPD warning level is 50% and the control limit is 67%.
Monthly Spike	6 per month	Laboratory SOP	Identify problem and correct	Laboratory technician	Precision	± 25%

Laboratory should follow method required QC Criteria.

QAPP Worksheet #28B: QC Samples Table
TAL Metals

Matrix	Soil/Aqueous[1]
Analytical Group	TAL Metals
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	SW846 6010C
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	One MS/MSD pair per preparation batch per matrix	Recovery Limits: 75-125%	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Within in-house limits

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28B (Continued): QC Samples Table
TAL Metals

Matrix	Soil/Aqueous[1]
Analytical Group	TAL Metals
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	SW846 6010C
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Recovery Limits: within standard reference material limits	Correct problem, then re-prep and re-analyze the LCS and all associated batch samples for failed analytes, if sufficient sample volume is available and samples are within 2x the hold time. Qualify data accordingly if reprep & re-analysis cannot be performed or if reprep & reanalysis also has failed analytes	Lab Manager/ Analyst	Accuracy	within standard reference material limits
Initial and Continuing Calibration Blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > 2 × MDL	Any sample associated with a blank that fails the criteria checks will be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.	TestAmerica - St. Louis Analyst	Accuracy	No analytes detected > 2 × MDL

[1]Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28B (Concluded): QC Samples Table
TAL Metals

Matrix	Soil/Aqueous[1]
Analytical Group	TAL Metals
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	SW846 6010C
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Serial dilution	Each new sample matrix	1:5 dilution must agree within ±10% of original determination.	Perform post-digestion spike if serial diltion does not meet criteria	TestAmerica - St. Louis Analyst	Accuracy	1:5 dilution must agree within ±10% of original determination.
Post-digestion spike	When serial dilution or matrix spike fails	Recovery within 80-120%	Re-analyze post-digestion spike.	TestAmerica - St. Louis Analyst	Accuracy	Recovery within 80-120%

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28C: QC Samples Table
Mercury

Matrix	Soil/Aqueous[1]
Analytical Group	Mercury
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	SW846/7471B
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected greater than one-half RL and 1/10 the amount measured in any sample or 1/10 regulatory limit (whichever is greater). No laboratory common contaminants detected greater than RL.	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	Lab Manager/ Analyst	Representativeness	Acceptable results per stated QC Acceptance Limits
MS/MSD	One MS/MSD pair per preparation batch per matrix	Recovery Limits: 51-148%	Identify problem; if not related to matrix interference, re-reanalyze MS/MSD and all associated batch samples	Lab Manager/ Analyst	Precision/Accuracy	Within in-house limits

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28C (Concluded): QC Samples Table
Mercury

Matrix	Soil/Aqueous[1]
Analytical Group	Mercury
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	SW846/7471B
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS/LCSD	One LCS or LCS/LCSD pair per preparation batch per matrix	Recovery Limits: 80-120%	Correct problem, then re-prep and re-reanalyze the LCS and all associated batch samples for failed analytes, if sufficient sample volume is available and samples are within 2x the hold time. Qualify data accordingly if reprep & re-analysis cannot be performed or if reprep & reanalysis also has failed analytes	Lab Manager/ Analyst	Accuracy	Within in-house limits
Calibration Blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > 2 × MDL	Any sample associated with a blank that fails the criteria checks will be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.	TestAmerica - St. Louis Analyst	Accuracy	No analytes detected > 2 × MDL

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28D: QC Samples Table
Gamma Spectroscopy

Matrix	Soil/Aqueous[1]
Analytical Group	Gamma Spec.
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	HASL-300 GA-01-0R
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	TestAmerica – St. Louis Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Recovery Limits: Cs-137: 87-120% Co-60: 87-115% Am-241: 87-116%	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	TestAmerica – St. Louis Analyst	Accuracy	Within in-house limits
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	Correct problem, then re-reanalyze all samples processed with the duplicate	TestAmerica – St. Louis Analyst	Accuracy	Within in-house limits

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28E: QC Samples Table
Isotopic Uranium

Matrix	Soil/Aqueous[1]
Analytical Group	Isotopic Uranium
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	HASL-300 A-01-R
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	TestAmerica – St. Louis Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Percent Recovery: U-234: 84–120% U-238: 82-122%	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	TestAmerica – St. Louis Analyst	Accuracy	Within in-house limits

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28E (Concluded): QC Samples Table
Isotopic Uranium

Matrix	Soil/Aqueous[1]
Analytical Group	Isotopic Uranium
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	HASL-300 A-01-R
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Tracer	Per sample, blank, LCS, MS, MSD	U-232 tracer: ≥30% and ≤110%	Truncate carriers/tracers above 100% recovery to eliminate low biased results. Reprep and reanalyze sample if carrier is low (indicating high biased results) if there is activity in the sample above the reporting limit. No reanalysis if matrix interference is nonconformance during sample preparation.	TestAmerica – St. Louis Analyst	Accuracy	Within in-house limits
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	Correct problem, then re-reanalyze all samples processed with the duplicate	TestAmerica – St. Louis Analyst	Accuracy	Within in-house limits

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28F: QC Samples Table
Isotopic Thorium

Matrix	Soil/Aqueous[1]
Analytical Group	Isotopic Thorium
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	HASL-300 A-01-R
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	Correct problem, then re-reanalyze method blank and all samples processed with the contaminated blank	TestAmerica – St. Louis Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Percent Recovery: Th-230: 81–118%	Identify problem; if not related to matrix interference, re-reanalyze LCS and all associated batch samples	TestAmerica – St. Louis Analyst	Accuracy	Within in-house limits

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QAPP Worksheet #28F (Concluded): QC Samples Table
Isotopic Thorium

Matrix	Soil/Aqueous[1]
Analytical Group	Isotopic Thorium
Concentration Level	Low/Medium
Sampling SOP	2012
Analytical Method/ SOP Reference	HASL-300 A-01-R
Sampler's Name	Joel Petty
Field Sampling Organization	Weston Solutions, Inc. , RST 3
Analytical Organization	TestAmerica
No. of Sample Locations	20

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Tracer	Per sample, blank, LCS, MS, MSD	Th-229 tracer: ≥30% and ≤110%	Truncate carriers/tracers above 100% recovery to eliminate low biased results. Reprep and reanalyze sample if carrier is low (indicating high biased results) if there is activity in the sample above the reporting limit. No reanalysis if matrix interference is nonconformance during sample preparation.	TestAmerica – St. Louis Analyst	Accuracy	Within in-house limits
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	Correct problem, then re-reanalyze all samples processed with the duplicate	TestAmerica – St. Louis Analyst	Accuracy	Within in-house limits

[1] Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

QQAPP Worksheet #29: Project Documents and Records Table

Sample Collection Documents and Records	Analysis Documents and Records	Data Assessment Documents and Records	Data Assessment Documents and Records	Other
Field Notes Digital Photographs Chain-of-Custody (COC) Records Air Bills Copies of Pertinent e-mails. Field Instrument Records	Record of Field Instrument. Measurements and Radiological Readings. Radiological Dosimetry Records. Corrective Action Reports. Radiological Instrument Calibration Readings.	Copies of all Analytical Data Deliverables; hard copies of raw data are archived; The raw data files from the laboratory include Analytical Instrument Calibration Records, COC Records, and Sample Preparation and Analysis Files, Sample Receipt Records	Copies of all Analytical Data Deliverables; hard copies of raw data are archived; The raw data files from the laboratory include Analytical Instrument Calibration Records, COC Records, and Sample Preparation and Analysis Files, Sample Receipt Records	Staff Health and Safety Records; CLP Request Form and RST 3 Analytical Request Form

QAPP Worksheet #30: Analytical Services Table

Matrix	Analytical Group	Concentration Level	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
Air	Radon	Low	EPA Method 402-R-92-014	28 Days	Accu-View Property Inspections, Inc. PO Box 641 Buffalo, NY 14051 716-882-2200 Radon Testing Corporation of America 2 Hayes Street Elmsford, New York 10523 914-345-3380	NA
Soil/Aqueous	TAL Metals	Low/Medium	See Worksheet #23	28 Days	TestAmerica 13715 Rider Trail North St. Louis, MO 63045 Mike Franks 314-298-8566	NA
Soil/Aqueous	Mercury	Low/Medium	See Worksheet #23	28 Days	TestAmerica 13715 Rider Trail North St. Louis, MO 63045 Mike Franks 314-298-8566	NA
Soil/Aqueous	Radiochemistry	Low/Medium	See Worksheet #23	28 Days	TestAmerica 13715 Rider Trail North St. Louis, MO 63045 Mike Franks 314-298-8566	NA

NA – Not Applicable

QAPP Worksheet #31: Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (Title and Organizational Affiliation)
Laboratory Technical Systems/ Performance Audits	Every year	External	Regulatory Agency	Regulatory Agency	RST 3-Procured Laboratory	RST 3-Procured Laboratory	EPA, State, NRC, or other Regulatory Agency
Performance Evaluation Samples	Every year	External	Regulatory Agency	Regulatory Agency	RST 3-Procured Laboratory	RST 3-Procured Laboratory	EPA, State, NRC, or other Regulatory Agency
Proficiency Testing	Semiannually	External	NELAC	PT provider	Lab Personnel	Lab Personnel	Lab QA Officer
NELAC	Every two years	External	NELAC	NELAC Representative	Lab QA Officer	Lab Personnel	NELAC Representative
Internal Audit	Annually	Internally	TestAmerica Laboratories, Inc.	Lab QA Officer	Lab Personnel	Lab Personnel	Lab QA Officer

NRC: Nuclear Regulator Commission

QAPP Worksheet #32: Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Project Readiness Review	Checklist or logbook entry	RST 3 Site Project Manager, Weston Solutions, Inc.	Immediately to within 24 hours of review	Checklist or logbook entry	RST 3 Site Project Leader	Immediately to within 24 hours of review
Field Observations/ Deviations from Work Plan	Logbook	RST 3 Site Project Manager, Weston Solutions, Inc. and EPA OSC	Immediately to within 24 hours of deviation	Logbook	RST 3 Site Project Manager and EPA OSC	Immediately to within 24 hours of deviation
Laboratory Technical Systems/ Performance Audits	Written Report	RST 3-Procured Laboratory	30 days	Letter	RST 3-Procured Laboratory	14 days
On-Site Field Inspection	Written Report	QAO/HSO Weston Solutions, Inc.	7 calendar days after completion of the audit	Letter/Internal Memorandum	Weston's regional QAO and/or EPA OSC	To be identified in the cover letter of the report

QAPP Worksheet #33: QA Management Reports Table

Type of Report	Frequency (Daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
RST 3-Procured Laboratory Data (preliminary)	As performed	Two weeks from the sampling date	RST 3-Procured Laboratory	RST 3 Data Validator and RST 3 Site Project Manager
RST 3-Procured Laboratory Data (validated)	As performed	Up to 14 days after receipt of preliminary data	RST 3 Data Validators	RST 3 Site Project Manager and OSC, EPA Region II
On-Site Field Inspection	As performed	7 calendar days after completion of the inspection	RST 3 Site Safety Officer	RST 3 Site Project Manager
Field Change Request	As required per field change	Three days after identification of need for field change	RST 3 Site Project Manager	EPA, Region II OSC
Final Report	As performed	2 weeks after receipt of EPA approval of data package	RST 3 Site Project Manager	EPA, Region II OSC

QAPP Worksheet #34: Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Site/field logbooks	Field notes will be prepared daily by the RST 3 Site Project Manager and will be complete, appropriate, legible and pertinent. Upon completion of field work, logbooks will be placed in the project files.	I	RST 3 Site Project Manager
Chains of custody	COC forms will be reviewed against the samples packed in the specific cooler prior to shipment. The reviewer will initial the form. An original COC will be sent with the samples to the laboratory, while copies are retained for (1) the Sampling Trip Report and (2) the project files.	I	RST 3 Site Project Manager
Sampling Trip Reports	STRs will be prepared for each week of field sampling [for which samples are sent to an EPA CLP RAS laboratory]. Information in the STR will be reviewed against the COC forms, and potential discrepancies will be discussed with field personnel to verify locations, dates, etc.	I	RST 3 Site Project Manager
Laboratory analytical data package	Data packages will be reviewed/verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	E	RST 3-Procured Laboratories
Laboratory analytical data package	Data packages will be reviewed as to content and sample information upon receipt by EPA.	I	RST 3 Site Project Manager
Final Sample Report	The project data results will be compiled in a sample report for the project. Entries will be reviewed/verified against hardcopy information.	I	RST 3 Site Project Manager

QAPP Worksheet #35: Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved.	RST 3 Site Project Manager
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	RST 3 Site Project Manager
IIa	Chains of custody	Examine COC forms against QAPP and laboratory contract requirements (e.g., analytical methods, sample identification, etc.).	RST 3- procured laboratory - RST 3 data validator
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	RST 3- procured laboratory - RST 3 data validator
IIb	Laboratory data package	Determine potential impacts from noted/approved deviations, in regard to PQOs. Examples include PQLs and QC sample limits (precision/accuracy).	RST 3- procured laboratory - RST 3 data validator
IIb	Field duplicates	Compare results of field duplicate (or replicate) analyses with RPD criteria	RST 3- procured laboratory - RST 3 data validator

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa / IIb	Air	Radon	Sampling Method, Lab SOP, Calculations, QC Criteria	RST 3 Data Validation Personnel
IIa / IIb	Soil	TAL Metals & Mercury	Data Validation SOP for Analysis of Low/Medium Concentration for Total Metals & Mercury SW846 Methods 6040C/7471B & EPA SOP HW-2a/2b	RST 3 Data Validation Personnel
IIa / IIb	Soil	Radiological Parameters	Refer to methods listed in worksheet # 19 & 20	RST 3 subcontractor Data Validation Personnel

QAPP Worksheet #37: Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: Data, whether generated in the field or by the laboratory, are tabulated and reviewed for Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCCS) by the SPM for field data or the data validator for laboratory data. The review of the PARCC Data Quality Indicators (DQI) will compare with the DQO detailed in the site-specific QAPP, the analytical methods used and impact of any qualitative and quantitative trends will be examined to determine if bias exists. A hard copy of field data is maintained in a designated field or site logbook. Laboratory data packages are validated, and final data reports are generated. All documents and logbooks are assigned unique and specific control numbers to allow tracking and management.
Questions about Non-CLP data, as observed during the data review process, are resolved by contacting the respective site personnel and laboratories as appropriate for resolution. All communications are documented in the data validation record with comments as to the resolution to the observed deficiencies.

Where applicable, the following documents will be followed to evaluate data for fitness in decision making: EPA QA/G-4, *Guidance on Systematic Planning using the Data Quality Objectives Process,* EPA/240/B-06/001, February 2006, and EPA QA/G-9R, *Guidance for Data Quality Assessment*, A reviewer's Guide EPA/240/B-06/002, February 2006.

Describe the evaluative procedures used to assess overall measurement error associated with the project:
As delineated in the ***Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP (EPA-505-B-04-900A, March 2005); Part 2A: UFP-QAPP Workbook (EPA-505-B-04-900C, March 2005); Part 2B: Quality Assurance/Quality Control Compendium: Non-Time Critical QA/QC Activities (EPA-505-B-04-900B, March 2005);*** "Graded Approach" will be implemented for data collection activities that are either exploratory or small in nature or where specific decisions cannot be identified, since this guidance indicates that the formal DQO process is not necessary.

The data will be evaluated to determine whether they satisfy the PQO for the project. The validation process determines if the data satisfy the QA criteria. After the data pass the data validation process, comparison results with the PQO is done.

QAPP Worksheet #37: Usability Assessment (Concluded)

EPA will use the field measurements from the radiological surveys to determine the presence or absence of radon/thoron gas and gamma radiation, the analytical results from the radon sampling event will be used to ascertain the concentration of Radon-222 in on-site buildings, and the analytical results from the soil sampling event will be used by EPA to verify the presence of residual contamination and potential releases of radiation-containing material in soil associated with the Site.

Analytical data will be compared with EPA Generic Soil Screening Levels for ingestion. EPA will use the analytical data from this investigation to determine if soil and slag at the Site contains elevated concentrations of TAL metals and radionuclides

Identify the personnel responsible for performing the usability assessment: Site Project Manager, Data Validation Personnel, and EPA, Region II OSC

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

A copy of the most current approved QAPP, including any graphs, maps and text reports developed will be provided to all personnel identified on the distribution list.

ATTACHMENT A

Site Location Map

ATTACHMENT B

Sampling SOPs

EPA/ERT SOP # 2001, 2012, 2050 - General Field Sampling Guidelines

ATTACHMENT C

Protocol for Conduction Radon and Radon Decay
Product Measurements in Multifamily Buildings